Making rewilding fit for policy

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Nathalie Pettorelli[1,*] Jos Barlow[2], Philip A. Stephens[3], Sarah M. Durant[1], Ben Connor[4], Henrike Schulte to Bühne[1], Christopher Sandom[5], Jonathan Wentworth[6], Johan T. du Toit[7]

[1]Institute of Zoology, Zoological Society of London, Regent's Park, London NW1 4RY, UK.
[2]Lancaster Environment Centre, Lancaster University, Lancaster LA1 4YQ, UK.
[3]Conservation Ecology Group, Department of Biosciences, Durham University, Durham DH1 3LE, UK.
[4]British Ecological Society, Charles Darwin House, London WC1N 2JU, UK.
[5]University of Sussex, Brighton BN1 9RH, UK.
[6]Parliamentary Office of Science and Technology, Houses of Parliament, Westminster, London SW1A 0AA, UK
[7]Department of Wildland Resources, Utah State University, Logan, UT 84322, USA

*Corresponding author: Nathalie Pettorelli, nathalie.pettorelli@ioz.ac.uk; telephone: +44 (0)207 4496334; fax: +44 (0)207 5862870.

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Summary

1. Rewilding, here defined as the restoration or reorganization of the biota and ecosystem processes to achieve a preferred outcome for an identified social-ecological system, is increasingly considered as an environmental management option with potential for enhancing both biodiversity and ecosystem services.
2. Despite the burgeoning interest in the concept, there are uncertainties and difficulties associated with the practical implementation of rewilding projects, while the evidence available for facilitating sound decision-making for rewilding initiatives remains limited.
3. We identify five key research areas to inform the implementation of future rewilding initiatives: increased understanding of the links between actions and impacts; improved risk assessment processes, through e.g. better definition and quantification of ecological risks; improved predictions of spatio-temporal variation in potential economic costs and associated benefits; better identification and characterisation of the likely social impacts of a given rewilding project; and facilitated emergence of a comprehensive and practical framework for the monitoring and evaluation of rewilding projects.
4. Policy implications. Environmental legislation is commonly based on a 'compositionalist' paradigm itself predicated on the preservation of historical conditions characterised by the presence of particular species assemblages and habitat types. However, global environmental change is driving some ecosystems beyond their limits so that restoration to historical benchmarks or modern likely equivalents may no longer be an option. This means that the current environmental policy context could present barriers to conducting the large-scale, long-term ecological experiments required to gather the evidence needed

for rewilding to be considered as an evidence-based policy option. Opportunities such as the UK's decision to leave the European Union could be used to develop novel land management approaches focused on payments for the delivery of desired ecosystem services, which could accommodate the piloting of well monitored and evaluated rewilding initiatives, altogether supporting the development of the required evidence base.

Key-words: Ecosystem Processes; Ecosystem Services; Environmental Legislation; Monitoring and Evaluation; Restoration; Wildlife Management

Rewilding: a captivating, controversial, 21st century concept to address ecological degradation

During recent decades humans have dramatically hastened alterations to, and loss of, biodiversity worldwide (Millennium Ecosystem Assessment, 2005; Living Planet Report, 2014). As evidence mounts that extinctions are altering key processes important to the productivity and sustainability of Earth's ecosystems (Cardinale et al., 2012), environmental managers are faced with the pressing challenge of developing conservation actions that promote biodiversity retention and recovery to previously observed levels while supporting economic and societal development. At the same time, global environmental change is driving some ecosystems beyond their limits so that restoration to historical benchmarks or modern likely equivalents may no longer systematically be an option; in such cases a new approach is needed to maximise ecosystem services delivery from novel ecosystems. Among the remedial actions to the current biodiversity crisis under consideration, the concept of rewilding has emerged as a promising, ubiquitous strategy to enhance biodiversity, ecological resilience, and ecosystem service delivery (Monbiot, 2014; Pereira & Navarro, 2015).

Conservation scientists and policy makers have become increasingly interested in rewilding in recent years (Lorimer et al., 2015; Merckx & Pereira, 2015; Jepson, 2016). Originally associated with the restoration of large, connected wilderness areas that support wide-ranging keystone species such as carnivores (Soulé & Noss, 1998), more recently rewilding has acquired a broader scope and four different forms have emerged: Pleistocene rewilding (involving the restoration of ecosystems to some Pleistocene baseline); trophic rewilding (involving introductions to restore top-down trophic interactions); ecological rewilding (allowing natural processes to regain dominance);

88 and passive rewilding (primarily involving land abandonment and the removal of
89 human interference; Table 1; Corlett, 2016a).

90 Rewilding is perceived by many scientists to be different from restoration, with
91 restoration aiming to return ecosystems to the way they were, sometimes using
92 continuous human interventions, and rewilding aiming to return a managed area back
93 to the wild in the form of a self-sustaining ecosystem, using minimal intervention
94 (Corlett, 2016a). However, the distinction between the two concepts is not clear-cut: for
95 example, "passive restoration" of forests is common in tropical landscapes (e.g. Melo et
96 al., 2013) and the recently coined term "open-ended restoration" refers to restoration
97 approaches that advocate minimal intervention and the reduction or removal of human
98 influence, as well as acceptance of future trajectories of ecological change (Hughes,
99 Adams & Stroh, 2012).

100 Rewilding projects have now been called for, or implemented, in various countries
101 (Figure 1) and for a variety of purposes, including kick-starting vegetation succession
102 (Navarro & Pereira, 2015; Trees for Life, 2015); restoring top-down trophic interactions
103 (Naundrup & Svenning, 2015) and predation processes (Donazar et al., 2016; Svenning
104 et al., 2016); and improving ecosystem services delivery through the introduction of
105 ecosystem engineers (Cerqueira et al., 2015; Carver, 2016). Rewilding tries to appeal to
106 the imagination of the general public and could help trigger interest in, and support for,
107 the conservation agenda. Some rewilding proposals are, however, rather alarming –
108 even bizarre – to public opinion (e.g. Bowman, 2012) and so the concept has yet to gain
109 wide recognition as a scientifically supported option for environmental management.
110 Scientific debate about the use of rewilding centres on the following themes: (1) the role
111 of human intervention in rewilding projects; (2) the ecological state and functions that

112 rewilding projects aim to (re)instate; (3) the spatial scale at which rewilding projects
113 need to be implemented; (4) the place of humans in rewilded landscapes and (5) the
114 risks involved with the introduction of novel species (Jørgensen, 2015; Corlett, 2016a,b;
115 Nogués-Bravo et al., 2016). On top of this long and fairly substantial list of scientific
116 concerns, rewilding has attracted critics from a wide range of stakeholders outside the
117 scientific community, on legal, political, economic and cultural grounds (see e.g. Lorimer
118 & Driessen, 2014; Arts, Fischer & van der Wal, 2016; Bulkens, Muzaini & Minca, 2016).
119 Overall, this has led to calls for caution and questions about the readiness of the
120 rewilding approach for widespread implementation (Nogués-Bravo et al., 2016), and for
121 an evidence base to show the effectiveness of rewilding measures in different contexts.

122 There is a need to progress the rewilding agenda, turning this concept into a
123 scientifically-sound and fit-for-policy conservation approach. To that end, we introduce
124 key definitions and considerations required to embrace fully the currently multi-faceted
125 nature of rewilding. We also highlight research priorities that must be addressed to
126 support the implementation of any successful future rewilding initiative. Finally, we
127 discuss potential policy barriers to conducting the large-scale, long-term ecological
128 experiments required to gather the evidence needed for rewilding to be considered as
129 an evidence-based policy option.

130

131 **Embracing the multi-faceted nature of rewilding**

132 To date, rewilding literature has generally referred to wilderness as areas where
133 natural processes are permitted to operate without human interference (Lorimer et al.,
134 2015). This reinforces the popular perception that the absence of sustained human

intervention is central to the rewilding process (Corlett, 2016b). However, for three reasons, the notion that wild areas must be free of human influence is unnecessarily restrictive. First, one or more human species have been an integral part of most ecosystems in Africa and Asia for over 2 million years. Second, experience accumulated during the development of the global protected area network indicates that any return to a "fortress conservation" approach is unlikely to work (West, Igoe & Brockington, 2006). Third, allowing people to interact with, and be part of, wild ecosystems should be compatible with facilitating the emergence of self-sustaining ecological units. Indeed, in most cases it would be impractical to suggest otherwise, as the ecosystems requiring restoration or rewilding are often on private lands or in regions where human activities are fully established (see e.g. Brancalion et al., 2013, 2016). Acknowledging that human interventions might be required for brief, targeted management actions does not invalidate rewilding as a long-term way of allowing nature to take care of itself. As a result, an appropriate definition of rewilding must embrace the global diversity of interpretations of rewilding, and the variety of perceptions of what the wild resembles and what natural means (Jørgensen, 2015). These perceptions vary geographically and culturally, and are linked to people's access to nature (Carver, Evans & Fritz, 2002; Diemer, Held & Hofmeister, 2003; Bauer, Wallner & Hunziker, 2009).

Much of the controversy and discomfort associated with the concept of rewilding may be caused by semantics (Corlett, 2016b). The 're' of rewilding implies a return to some previous state, or historical benchmark, which might be possible within specific spatial and temporal scales (Rohwer & Marris, 2016). But continual global change is likely to make that goal unattainable in many situations (Marris, 2013). In this context we agree with Corlett that a new vocabulary is needed so that the rewilding discussion can

become relevant to both restoration and forward-looking approaches to enhancing the functional properties of ecologically-degraded landscapes under a changing climate. In the latter case, *rewilding by reorganization* replaces *rewilding by restoration*, with the 're' of reorganization implying a modified arrangement of 'wildness' by design, with the primary objective being functional (Kowarik, 2011; Lennon, 2015).

In the context of global environmental change and unprecedented extinction rates, limiting rewilding to ecological restoration (defined as the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed; Wortley, Hero & Howes, 2013) would substantially constrain the scope of what rewilding could achieve. We recognize that rewilding as an established concept still lacks a formally agreed definition - and therefore incorporation into policy – and has yet to be proven useful as a conservation tool, particular to deliver likely future conservation objectives. With this in mind, we define rewilding as the *restoration or reorganization of the biota and ecosystem processes to achieve a preferred outcome for an identified social-ecological system*. This definition encapsulates the various forms of rewilding that have emerged so far, including trophic rewilding, Pleistocene rewilding, ecological rewilding and passive rewilding, as well as some activities that have previously been labelled as restoration (such as passive restoration or restoration reserves). Ecosystem processes are here understood as transfers of energy, material, or organisms among compartments in an ecosystem, following the definition introduced by Lovett et al. (2006). Examples of ecosystem processes thus include primary and secondary production, decomposition, heterotrophic respiration and evapotranspiration, which constitute the biological machinery that provides ecosystem services. Social-ecological

systems are broadly defined as linked systems of people and nature, where humans are seen as part of, and not apart from, nature (Berkes & Folkes, 1998).

Defining a research agenda for rewilding

Recent reviews have concluded that the literature on rewilding remains heavily dominated by essays and opinion pieces, rather than empirical studies (Lorimer et al., 2015; Svenning et al., 2016). The existing emphasis on anecdotal evidence and subjective opinion means that scientific understanding of the risks and benefits of rewilding is currently inadequate to support sound policymaking. In particular, there is a lack of empirical information to support any decision framework through which rewilding could be objectively selected as a preferred management approach. More ecological, quantitative, data-driven research is required; but that research must be supported by a clear agenda, targeting key questions likely to best inform future management decisions on rewilding. Here, we identify five research areas where incomplete or poor information hinders the use of rewilding.

1. Improved understanding of the links between actions and impacts. Rewilding is an umbrella term that refers to a variety of management actions (such as reintroduction, eradication, outplanting) used solely or in combination to deliver on a given target. But what are the typical targets and actions considered by rewilding projects and what are the possible ecological and ecosystem processes that can benefit from rewilding initiatives? Reducing over-grazing, creating and maintaining a heterogeneous habitat mosaic, and promoting native vegetation are, for example, all targets that have been considered by rewilding projects (Table 2). Rewilding projects are moreover rarely

motivated primarily by a desire to enhance primary productivity or heterotrophic respiration, yet many projects claim they will ultimately contribute to restoring ecosystem processes and/or functions. This claim is rarely substantiated theoretically or empirically; the substantiation of this claim is also not helped by the confusion existing around the concepts of ecosystem process, ecosystem function and ecosystem services (Pettorelli et al., 2017). Because of the uncertainty of causal links between targets, actions and desirable outcomes, the design of rewilding projects is currently more likely to be driven by opinion and preference, than to be firmly evidence-based. We argue that management targets, management actions, and ecological and ecosystem processes impacted need to be clearly identified in future rewilding project implementation plans, so that adequate monitoring and evaluation plans can be drawn up early on. For this to happen, however, we require an improved understanding of the possible management actions for a given target, and how they may each impact ecological and ecosystem processes.

2. *Risk assessment*. Ecological systems are complex, and so rewilding will have an element of unpredictability in its outcomes, which may vary with local conditions and the rewilding approach (i.e., Pleistocene, passive, trophic, ecological) considered. Moreover, rewilding will occur in given socio-economic and political contexts: ineffective rewilding that is either very slow, or perceived to be less effective than alternative management approaches, could place projects and their ecological outcomes in jeopardy (Zahawi, Reid & Holl, 2014). Environmental management always operates in a realm where uncertainties dominate (Ludwig, Hilborn & Walters, 1993) but adequate risk management can significantly improve the ability of policies to perform well despite scientific uncertainty (Schindler & Hilborn, 2015). We need research that

facilitates the emergence of improved risk assessment processes, through e.g. the clear identification of ecological risks associated with each rewilding variant; the collection of information allowing the quantification of these risks according to local context; and the development of an agreed decision framework that could be used to identify, for a set of given conditions, which variant is associated with the lowest ecological risk. Understanding the time needed to deliver expected rewilding outcomes is also important for managing expectations, and the potential risks associated with failing to deliver on these expectations, for a given set of social attitudes and a given policy context. Ultimately, being able to frame these risks realistically will allow appropriate mitigation measures to be put in place.

3. *Potential economic costs and associated benefits assessment*. Economic costs form the basis for many conservation policies, but we still know very little about the ability of different conservation interventions, including rewilding, to deliver conservation benefits for a given cost (McCreless et al., 2013). In the case of rewilding, little information is there to predict what the cost of intervention may be, while a clear identification of potential benefits is mostly lacking. This makes it very difficult to assess the relative expenditure to benefit ratio of rewilding against other alternative interventions (Possingham et al., 2001). Yet, an economic assessment of rewilding is fundamental to cost-effective decision making since limited conservation resources must be spent wisely to deliver sustainable solutions and maximize conservation impact. Importantly, “passive” options often have inherent and overlooked risks which may be more explicitly defined in active approaches, and the relative costs and benefits of each over time will depend on issues such as land tenure, opportunity costs and the need for long-term investments (Zahawi, Reid & Holl, 2014). Overall, research is thus

needed to improve predictions of spatio-temporal variation in potential economic costs and associated benefits to support decision-making and adaptive management in the long-run.

4. *Identification and characterisation of the likely social impacts*. One of the major handicaps to the utility of the rewilding concept is the perceived impact of rewilding projects on society. If mitigation of direct impacts of human presence on rewilding project success entails reduced access to lands by local communities, then key stakeholders may become alienated. Some people living close to where rewilding initiatives are being implemented might suffer the costs of enhanced wildlife, in the form of crop and livestock depredation for example, while others may benefit from wildlife through ecotourism or associated ecosystem services. Hence, the costs and benefits of rewilding interventions are likely to be unevenly distributed across households and could thus exacerbate inequities within communities. A better understanding of the potential socio-economic impacts of rewilding, for each type of rewilding considered and in a given socio-economic context, needs to be developed to be able to understand and mitigate against such unintended consequences. Arguably, most conservation interventions are still implemented without a clear identification and characterisation of the likely social impacts (Baylis et al., 2016) and so rewilding is currently associated with the same drawbacks characterising alternative options. At the same time, rewilding will need early successes to convince and eventually become mainstream in environmental management. In that respect, identifying with the highest confidence possible which location and which type of rewilding project may deliver the best societal outcomes would be particularly valuable to decide strategically which projects should be implemented first.

5. *Monitoring and evaluation*. For any variant of the four forms of rewilding to be considered as a management option, a critical and practical scientific framework for its monitoring and evaluation needs to be in place. As previously mentioned, this will require clarity about the expected outcomes of rewilding initiatives, but also clarity about the monitoring methods available for assessing these outcomes across various spatial and temporal scales. Preferred outcomes are likely to be centred on the concept of ecosystem services; possible desired outcomes thus include the delivery of new services and/or the enhanced delivery of certain services. Given these constraints, monitoring and evaluation is likely to be much harder for rewilding, where success will be assessed by changes in processes and flows, than for other types of management interventions (such as restoration), which primarily target a particular state. Indeed, how to measure changes in ecosystem processes and services delivery in a standardised way is still open to debate (Geijzendorffer & Roche, 2013; Balvanera et al., 2016), while the practicalities of doing so can involve substantial data collection efforts. For example, carbon stocks in a forested system can be assessed in a cost-effective way in a single visit, but monitoring decomposition requires long-term and year round measurements. Additionally, rewilding initiatives are all expected to benefit people, meaning that monitoring and evaluation processes should also assess the extent of societal benefit. There is currently little agreement on how this could be done, and, indeed, little acknowledgement that this should be part of any monitoring and evaluation plan associated with a rewilding project. Research on monitoring options for social impact (see e.g. Mascia et al., 2014) and ecosystem processes and services delivery (see e.g. Kupschus, Schratzberger & Righton, 2016) has grown substantially in the past decade, and these efforts could be used to support the identification of a comprehensive and practical framework for the monitoring and evaluation of rewilding projects.

Integrating rewilding in the current policy context

Rewilding represents a clear opportunity to involve policymakers and the wider public positively with the conservation agenda. In addition, rewilding presents opportunities to implement new projects that promote biodiversity retention and recovery, while restoring or enhancing the delivery of many ecosystem services, such as carbon sequestration and natural flood management. Yet, to achieve this potential and optimize chances of success, rewilding needs to be informed by the best science available: this can only happen if the broad community of ecologists and social scientists engage with rewilding, rather than relegating it to non-scientific arenas.

We have identified five research priorities to qualify rewilding as an evidence-based policy option: these priorities will require new projects to collect new data. Environmental legislation has a traditional focus on *in situ* conservation and the preservation of historical conditions, which have favoured the implementation of conservation projects aiming to restore previously observed benchmarks, facilitating data collection in these situations. However, global environmental change is also driving some species far beyond their traditional ranges and some ecosystems far beyond their limits: in such situations, restoring historical conditions may not be a realistic objective and the facilitation of the emergence of novel ecosystems may prove a more sensible and cost-effective alternative to address declining biodiversity and ecosystem services delivery. To assess how to best support the emergence of novel ecosystems in various socio-economic and ecological contexts, experimentation and environmental manipulation will need to be performed. Yet current policy drivers could present barriers to conducting these necessary large-scale, long-term ecological experiments.

In the European Union (EU), for example, two policy areas are currently particularly relevant to rewilding: biodiversity policy, and agriculture and land-use policy. Current EU biodiversity policy, underpinned in legislation by the Birds Directive and Habitats Directive, is based on a 'compositionalist' paradigm, predicated on the preservation of particular species assemblages and habitat types (Jepson, 2016). Such an approach is codified in law, with conservation policy driven by strong legislation that identifies targets for species and habitat protection. The protection of key communities, species and populations can in many cases be a legitimate target for an ecosystem services approach. However, some rewilding projects focused on ecosystem processes and embracing uncertain outcomes, could be difficult to accommodate within this policy framework. Determining whether it is possible to systematically develop appropriate targets for rewilding initiatives that are compatible with existing commitments is, thus, a key challenge.

Agriculture and land management policy is another key determinant of the viability of rewilding initiatives and experimental schemes. In the EU, the Common Agricultural Policy, which forms 40% of EU spending, incentivises particular land management options through the structure of agricultural support payments. Around 70% of payments under the Common Agricultural Policy are conditional on land being in "good agricultural condition" and free of "ineligible features" such as naturally regenerating scrub. Consequently, as it is currently formulated, the Common Agricultural Policy severely limits policy options to support rewilding initiatives.

Opportunities such as the UK's decision to leave the European Union offer a chance to develop novel environmental management funding mechanisms focused on payments for the delivery of desired ecosystem services, based on measurable outcomes rather

than prescriptive management measures. Such novel approaches could provide an enabling environment for piloting well monitored and evaluated rewilding initiatives, altogether supporting the development of the evidence base currently required to demonstrate the effectiveness of rewilding measures in different ecological and socio-economic contexts.

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557 Table 1: Type of rewilding, associated vision and aims, as well associated management

558 interventions

Type of rewilding	**Vision**	**Aim**	**Management interventions**	**Historical baseline**	**Scale**
Pleistocene rewilding	Promotion of large, long-lived species over pest and weed assemblages; facilitation of the persistence and ecological effectiveness of megafauna (Donlan et al., 2006)	Restoration of ecological processes lost in the late Pleistocene	Translocations (including ecological replacements)	pre-human Pleistocene	Large scale
Trophic rewilding	Promotion of self-regulating biodiverse ecosystems (Svenning et al., 2016)	Restoration of top-down trophic interactions and associated trophic cascades	Translocations (including ecological replacements)	Not specified	Not specified
Ecological rewilding	Promotion of natural processes dominance (Corlett, 2016b)	Restoration of ecological processes	Translocations (including ecological replacements)	Not specified	Not specified
Passive rewilding	Reduction of human control of landscapes (Navarro & Pereira, 2015)	Restoration of natural ecosystem processes	Little to no management, although intervention may be required in the early stages of the restoration process	Not specified	Not specified

559

560 Table 2: Examples of targets that may be considered by rewilding initiatives, and how
561 these link to ecosystem processes and measurable outcomes

Target	Action	Ecological process(es) restored/enhanced	Ecosystem process(es) impacted	Measurable outcome(s)	References
Reduce over-grazing	Carnivore reintroduction	Predation	Primary and secondary production, evapotranspiration	Higher trophic complexity	Dobson (2014)
Creating and maintaining a heterogeneous habitat mosaic	Megaherbivore reintroduction	Herbivory	Primary production, evapotranspiration	Higher beta diversity	Vera (2009)
Reducing greenhouse gas emissions from permafrost soil	Megaherbivore reintroduction	Trampling	Primary production, decomposition, heterotrophic respiration, evapotranspiration	Reduced change in soil carbon stock	Zimov et al. (2005)
Promoting native vegetation	Megaherbivore reintroduction and/or herbivores exclusion/eradication, outplanting of native vegetation, removal of non-native species	Herbivory; seed dispersal	Primary production, decomposition, heterotrophic respiration, evapotranspiration	Native vegetation regeneration	Hansen et al. (2010), Sandom et al. (2013); Cid et al. (2014); Hodder (2014)
Restore self-regulating wetlands	Remove draining systems, reintroduce keystone species (beaver)	Water retention/flow Herbivory Habitat creation	Primary production, decomposition, heterotrophic respiration, evapotranspiration	Regeneration of hydrophilic/water tolerant vegetation; improved water quality; increased species richness	Wicken Fen Project (2017); Jones et al. (2009); Puttock et al. (2017)

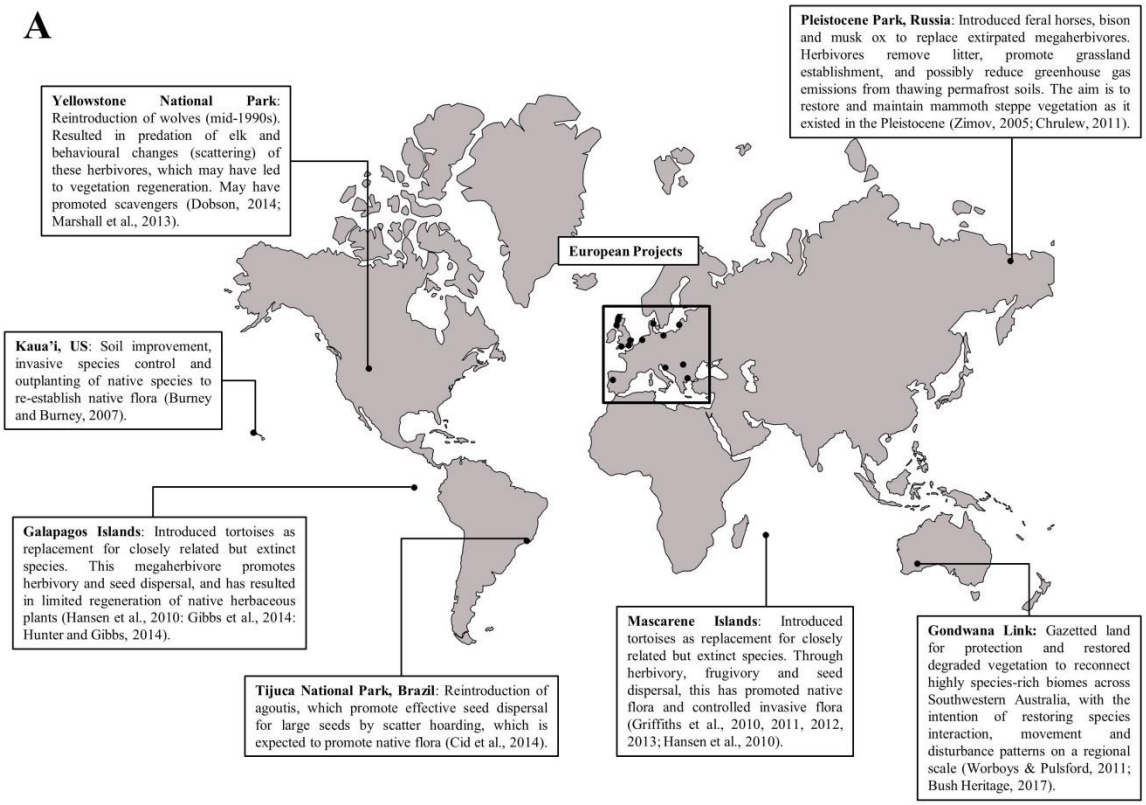
Increase population viability	Corridor creation	Predation, competition, herbivory	Primary and secondary production, evapotranspiration	Higher genetic diversity within populations	Worboys & Pulsford, (2011)
Restore disturbance regime	Megaherbivore reintroduction	Herbivory, carbon sequestration	Primary production, decomposition, heterotrophic respiration, evapotranspiration	Change in fire dynamics (occurrence, severity)	Rewilding Europe (2017)

562 **Figures**

563

564 Figure 1: Examples of currently ongoing projects overtly labelled as “rewilding” (A) in

565 the world and (B) in Europe.



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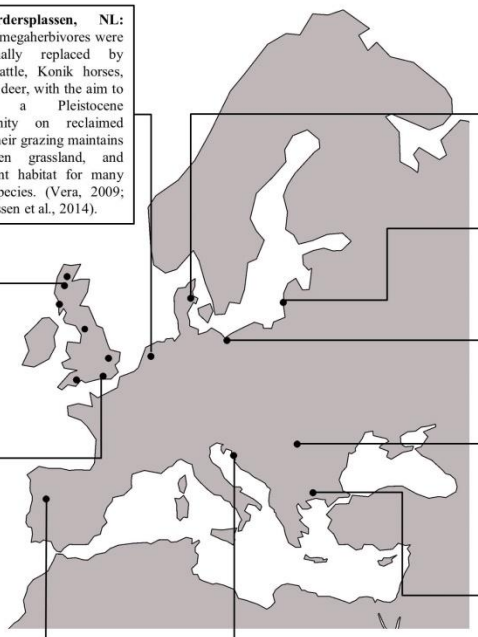
B



Projects in Scotland:

Alladale Wilderness Reserve: Trees were planted, anti-deer fence built and boar were reintroduced to this site (to establish germination niches for seedlings by rooting). The aim is to restore a core area of native Caledonian pinewood forest. (Sandom et al., 2013).

Glen Affric: Re-establishment of self-sustaining, native Caledonian pinewood forest. Current interventions include planting native trees and removing non-native trees, as well as excluding deer (Trees for Life, 2015; Sandom et al., 2013).

Knapdale Forest: The extirpated beaver was reintroduced in 2009 to create new wetland habitats and more diverse woodland structure (Jones et al., 2009, RZSS, 2014).

Projects in England:

Devon Beaver Project: Reintroduction of beavers, whose dams increased ponded water storage. This reduced peak discharge and pollutant load of downstream water, whilst increasing organic carbon load (Puttock et al., 2017).

Wicken Fen: Highland cattle and Konik ponies were introduced to this site to replace extirpated megaherbivores. Hydrological regime was restored to promote and maintain fen meadows and reduce scrub (Wicken Fen Project, 2017).

Knepp Castle: Introduced old breeds of pig, longhorn cattle, fallow deer and Exmoor ponies (Taylor, 2006; Hodder et al., 2014).

Wild Ennerdale: Galloway cattle were introduced, and sheep numbers were reduced, to restore browsing regime beneficial to regeneration of native trees. Restoration of waterways to allow fish migration and movement of sediment (Rewilding Britain, 2017).

Oostvardersplassen, NL: Extinct megaherbivores were functionally replaced by Heck cattle, Konik horses, and red deer, with the aim to install a Pleistocene community on reclaimed land. Their grazing maintains an open grassland, and important habitat for many other species. (Vera, 2009; Cornelissen et al., 2014).

Vorup Enge, Denmark: European bison and Holstein Jutland diary cows were reintroduced to this site to replace extirpated megaherbivores. The aim is to create a self-sustaining ecosystem which preserves Danish flora genetic variation (Randers Regnskoven, 2016).

Lake Pape, Lithuania: Introduced Konik horses as a replacement for extirpated wild horses in 1999 (Schwartz et al., 2005; Prieditis, 2012).

Oder Delta: New protected areas were established, with the aim to improve habitat quality so that regional wildlife can thrive (Rewilding Europe, 2017).

South Carpathians: Reintroduction of bison to promote herbivory; re-establishment of bark beetle disturbance (Rewilding Europe, 2017).

Rhodope Mountains: Introduced red and fallow deer, Konik and Karakachan horses to enhance herbivory, with the aim of controlling fire, creating a vegetation mosaic and sustaining scavengers and predators (wolves and several vulture species, Rewilding Europe, 2017).

West Iberia: Introduced horses and a primitive cattle breed ("tauros") as a replacement for extinct megaherbivores to re-establish herbivore control of vegetation dynamics (Helmer et al., 2015).

Velebit: Reintroduced Bosnian mountain horses, Konik horses and tauros (Helmer et al., 2015).

567